RSM Interpretation Pretest Tutorial

This tutorial provides step-by-step instructions for RSM interpretation. The steps shown in this tutorial are very similar to JITC RSM interpretation compliance testing, therefore providing developers experience and familiarity with the testing process.

Seven RSM TRE Sets are provided to assist/support an RSM exploitation application developer's pretest evaluation. The sample files can aide in the preparation testing of RSM exploitation applications before proceeding to JITC RSM compliance testing.

Each TRE Set contains different RSM TREs. Although RSM interpreters are eventually required to integrate all eight RSM TREs, implementation priority in the early stages of deployment should support RSM TREs that will be employed and available in actual first file release. A concentrated production of RSM data has been presented in the following TREs: RSMIDA, RSMPCA, RSMPIA and RSMECA. It is recommended exploiter development focus on supporting these four TREs as a priority to the eight TREs listed in the RSM specification.

The following is a list of required capabilities for all RSM exploitation applications. The application must present the user the following:

1) A corresponding row/column location from a supplied ground point location.
2) Partial derivative image row/column value from a supplied ground point location.
3) Partial derivative image row/column value from a supplied RSM adjustable parameter identification at supplied ground point location.
4) An RSM direct error covariance, from the corresponding original full image identification and number of active RSM "error model" adjustable parameters for each applicable image, and the (ordered) identification of these parameters for the associated image.
5) The RSM indirect error covariance for a set of images from the same sensor. For each image, the original full image ID and a set of image row/column locations are also specified in the request. The corresponding number and (ordered) identification of all active RSM "error model" adjustable parameters for each image (and common across images) are also requested as output, along with the RSM indirect error covariance.
6) The 2x2 unmodeled error covariance corresponding to a specified row/column location in the associated image. Also, AP can request the 2x2 unmodeled error cross-covariance corresponding to two specified row/column locations in the associated image (A ground point location(s) can be specified instead of a row/column location(s); the latter will be computed internally by the RSM exploiter.)
7) The illumination azimuth/elevation angles at specified image row/column location. (A ground point location can be specified instead of a row/column location; the latter will be computed internally by the RSM exploiter.)
8) The trajectory position/velocity at specified time.
9) The original full image ID.

10) The sensor ID.
11) The sensor type.
12) The original full image size.
13) The RSM image domain.
14) The edition ID.
15) The triangulation ID.
16) The RSM ground domain's height range.
17) The time-of-image corresponding to supplied row/column location. (A ground point location can be specified instead of a row/column location; the latter will be computed internally by the RSM exploiter.)
18) The identity and definition of RSM primary ground coordinate system
19) The polynomial and/or grid ground-to-image function fit error for all sections applicable to polynomials and/or all sections applicable to grids. For grids, the recommended interpolation order is also requested for each section.

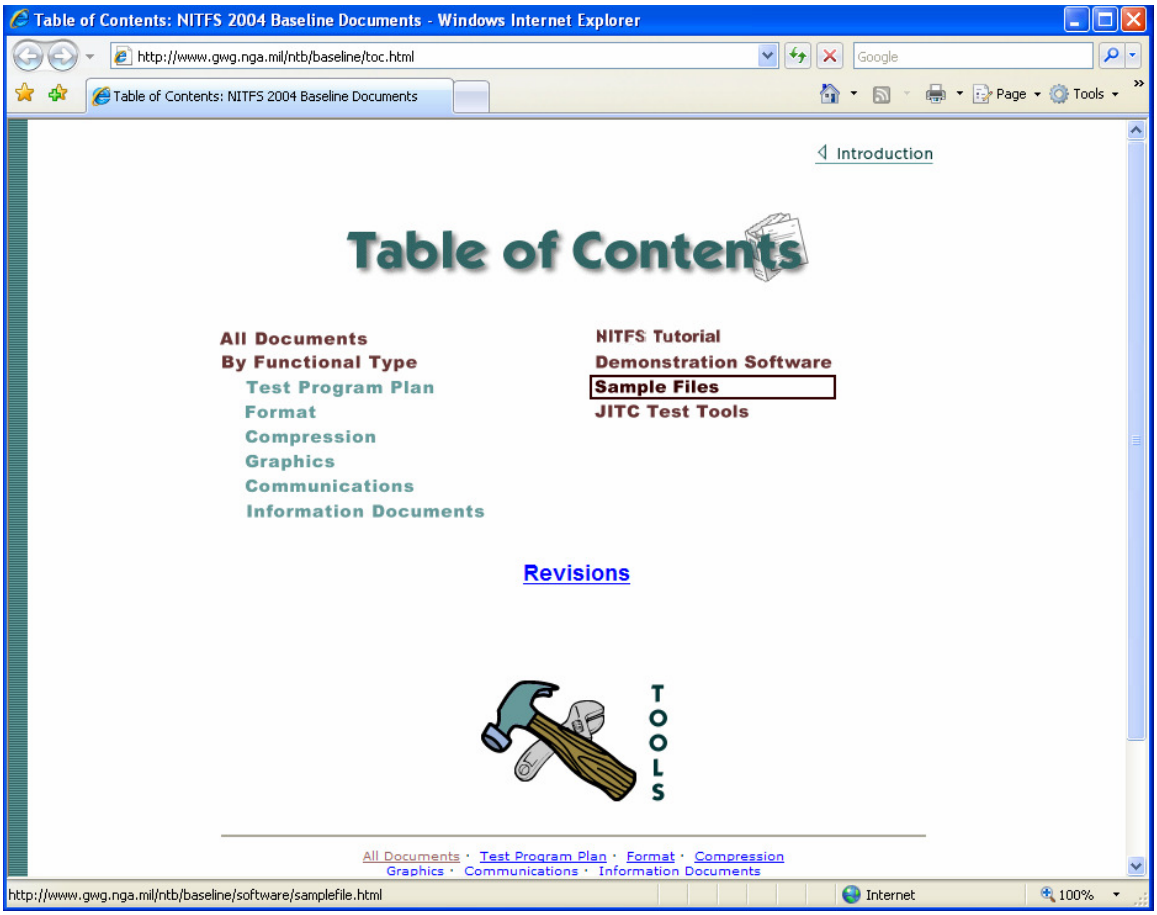
The following list provides the optional capabilities an interpreter may include:

1) The ground point horizontal coordinates at supplied image row/column and ground point height coordinate.
2) The value corresponding to the specified identity of an RSM adjustable parameter.
3) The identity of all active RSM adjustable parameters for the associated image that correspond to the RSM image support data error covariance, i.e., active "error model" adjustable parameters.
4) The RSM image support data error covariance element corresponding to the associated image and the specified identification of two RSM "error model" adjustable parameters.
5) The portion of the RSM direct error covariance associated with applicable images. Applicable images are the associated image and each image referenced by the RSM direct error covariance and for which an RSM TRE Set is available. The corresponding original full image identification, number of active RSM "error model" adjustable parameters and their (ordered) identification, are also requested for each applicable image.
6) The RSM indirect error covariance for a set of images from the same sensor in a "direct error covariance form", directly suitable for use in a triangulation solution process, as detailed in the RSMECA TRE description. For each image, the original full image ID is also specified in the request. The corresponding number and (ordered) identification of all active RSM "error model" adjustable parameters for each image (and common across images) are also requested as output, along with the RSM indirect error covariance. In the "direct error covariance form", the indirect error covariance is applicable to the images and independent of image row/column location(s). If there are k images and m adjustable parameter per image, the indirect error covariance is a km x km matrix.

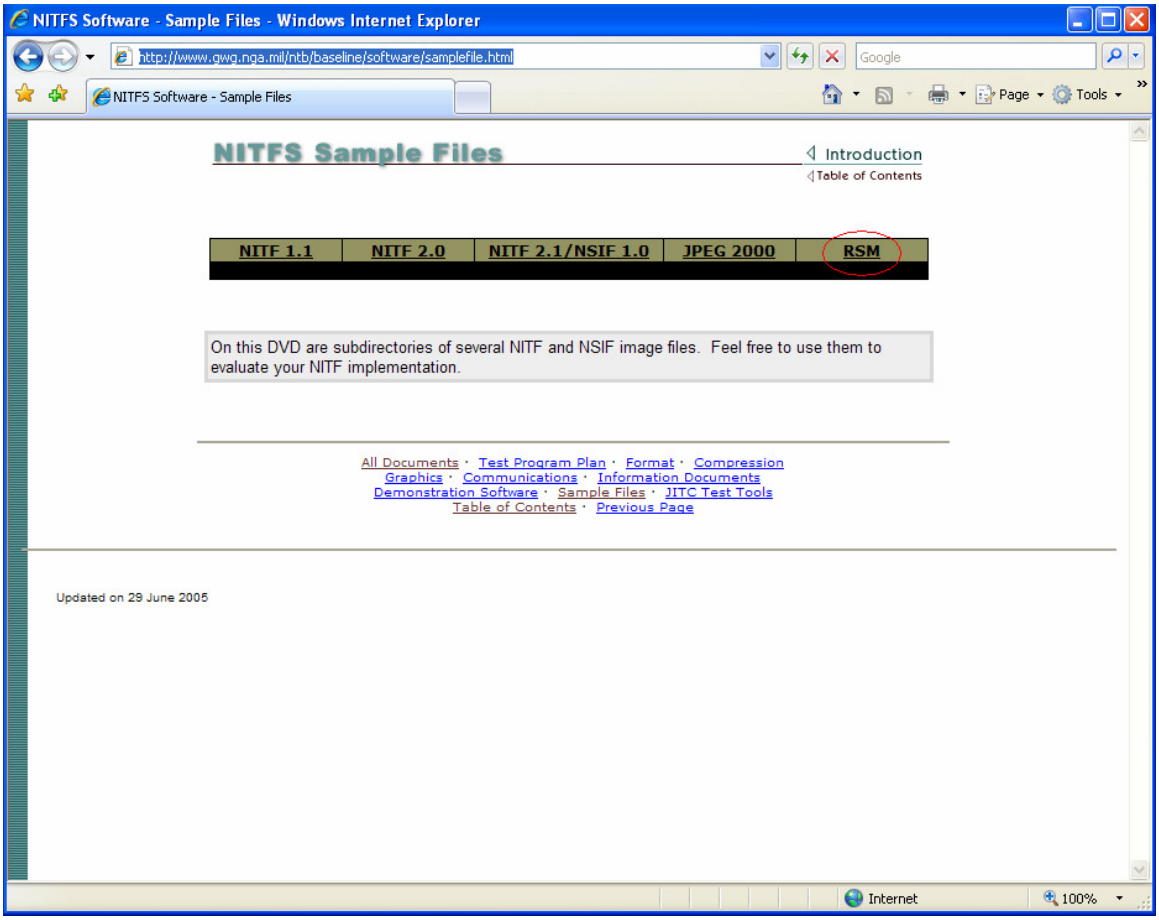
It is recommended to follow these steps to successfully accomplish compliance pre-testing for RSM interpretation.

Step 1. Download the sample files.

- Go to the NITF website at http://www.gwg.nga.mil/ntb/baseline/toc.html
    - Click on the Sample Files link

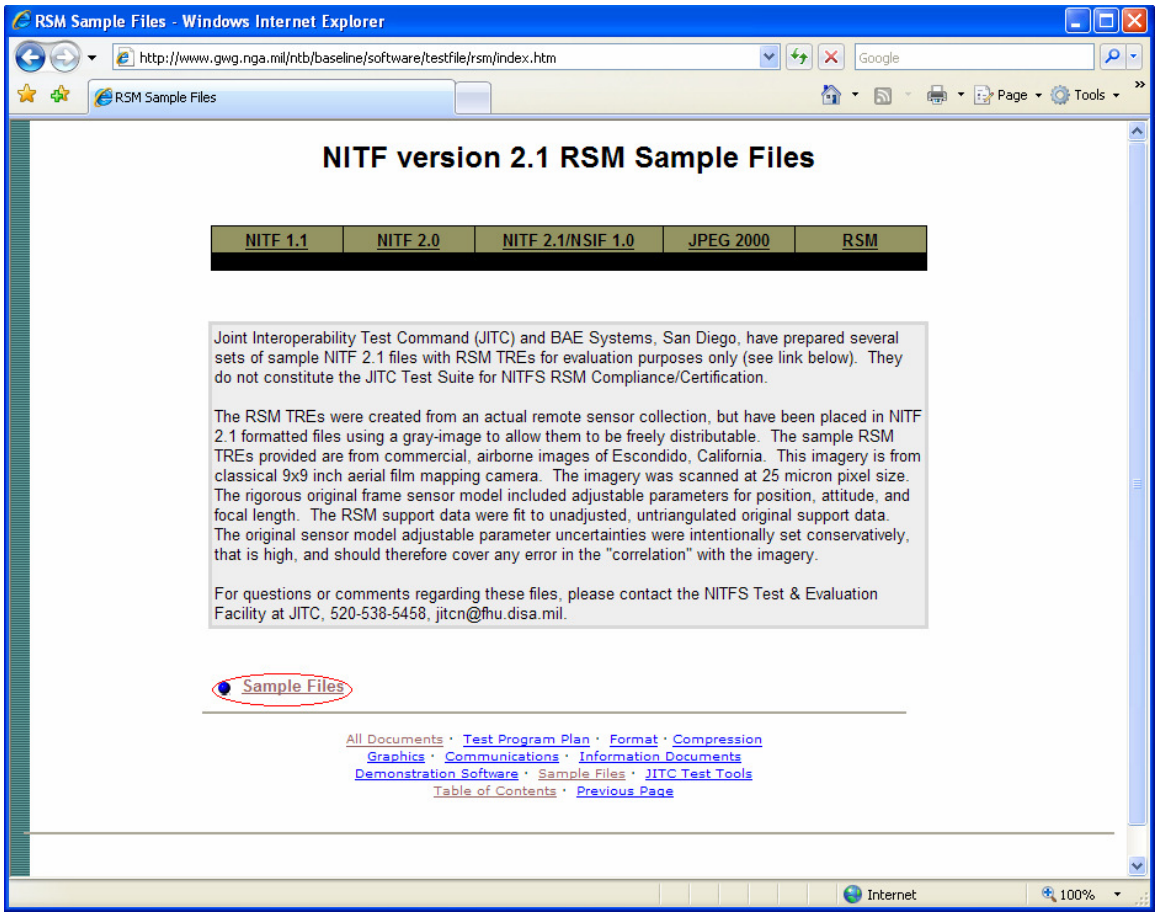


    - Click on the RSM link



- The RSM page provides a description of the data collected for the sample files. It also provides contact information if any questions or issues arise.

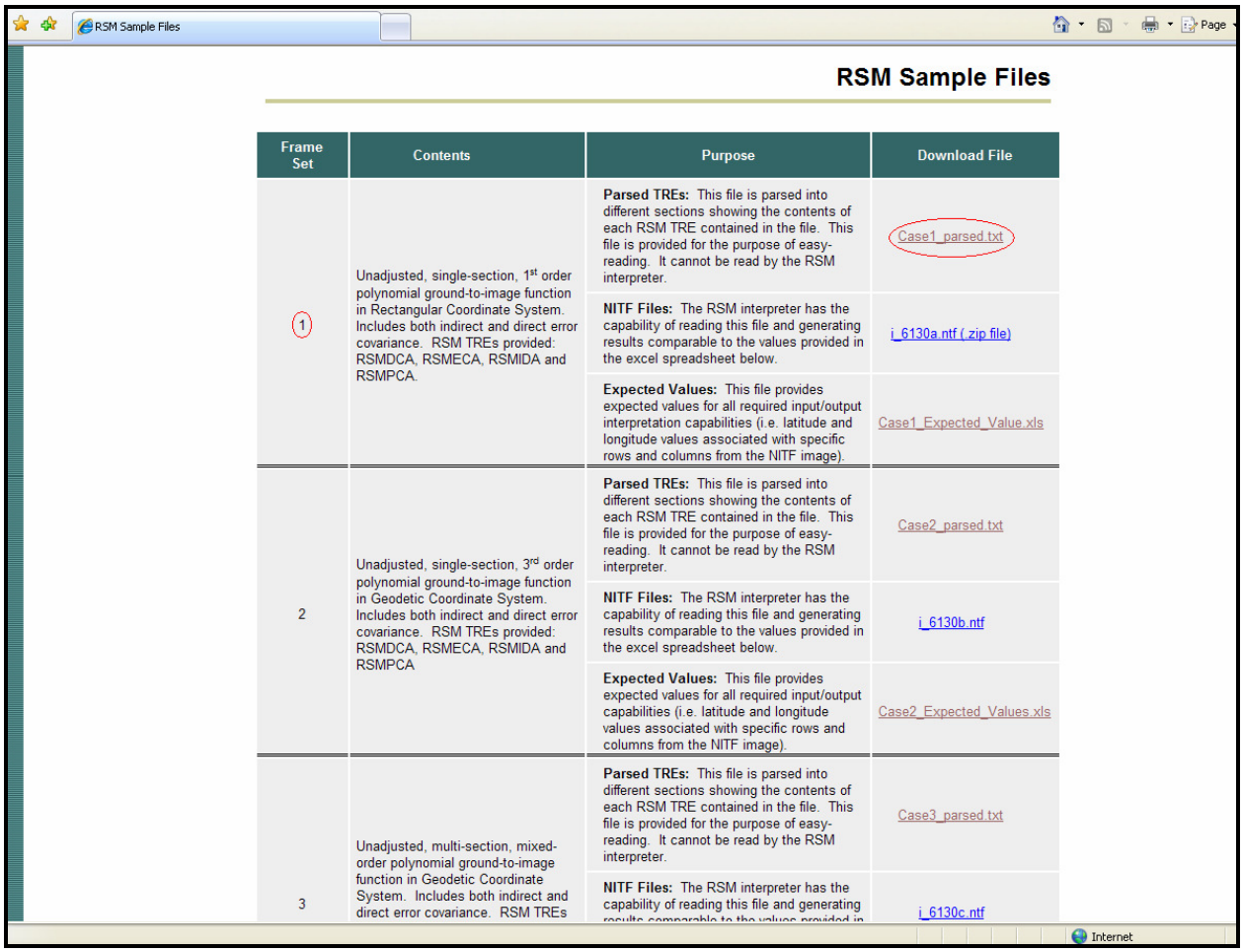
- Click on the Sample files link at the bottom of the data description paragraph.

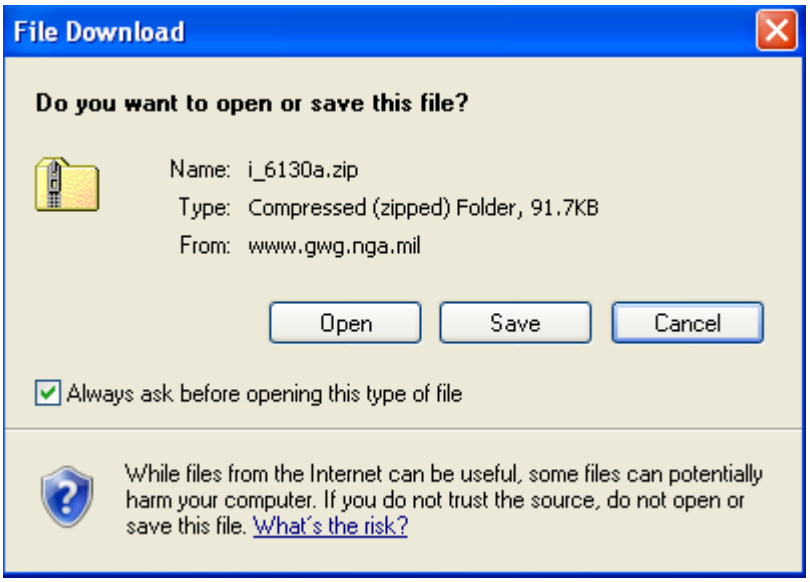


- The link takes you to the page containing all the sample files, as well as a text file showing what values are in each field in each TRE, and an excel spreadsheet containing all the known input/output values collected by the NITF lab using a trusted RSM interpreter.
- The table containing all the sample files provides a description on what a particular NITF file contains. Also available from the table is the purpose of each file provided on the right side of the table.
- You will notice all files are organized in groups (Frame Sets), each group labeled 1-7 on the left side of the table.

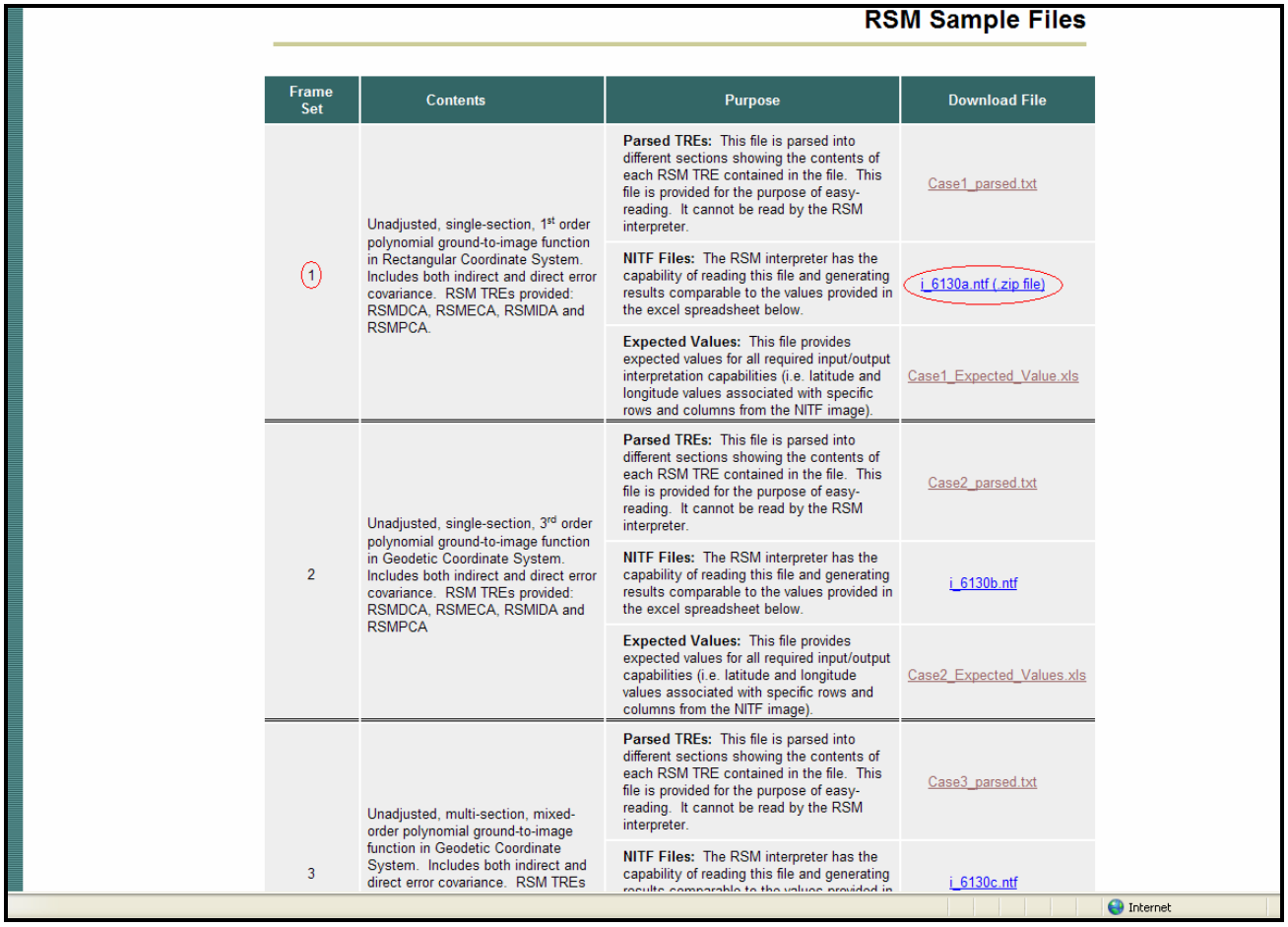
- To make downloading all files easier and more organized, it is recommended to create 7 folders on your hard drive, named Frame Set 1, Frame Set 2, etc. This will help keep all Frame Set files grouped together.

- First, within the Frame Set 1 row, download the text file located all the way to the right side of the table. Click on the file name (Case1_parsed.txt), and save the file to the folder Frame Set 1.


RSM Sample Files
Page
RSM Sample Files
Frame Set
Contents
Purpose
Download File
1
Unadjusted, single-section, 1st order polynomial ground-to-image function in Rectangular Coordinate System. Includes both indirect and direct error covariance. RSM TREs provided: RSMDCA, RSMECA, RSMIDA and RSMPCA.
Parsed TREs: This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.
Case1_parsed.txt
NITF Files: The RSM interpreter has the capability of reading this file and generating results comparable to the values provided in the excel spreadsheet below.
i_6130a.ntf (.zip file)
Expected Values: This file provides expected values for all required input/output interpretation capabilities (i.e. latitude and longitude values associated with specific rows and columns from the NITF image).
Case1_Expected_Value.xls
2
Unadjusted, single-section, 3rd order polynomial ground-to-image function in Geodetic Coordinate System. Includes both indirect and direct error covariance. RSM TREs provided: RSMDCA, RSMECA, RSMIDA and RSMPCA
Parsed TREs: This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.
Case2_parsed.txt
NITF Files: The RSM interpreter has the capability of reading this file and generating results comparable to the values provided in the excel spreadsheet below.
i_6130b.ntf
Expected Values: This file provides expected values for all required input/output capabilities (i.e. latitude and longitude values associated with specific rows and columns from the NITF image).
Case2_Expected_Values.xls
3
Unadjusted, multi-section, mixed-order polynomial ground-to-image function in Geodetic Coordinate System. Includes both indirect and direct error covariance. RSM TREs
Parsed TREs: This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.
Case3_parsed.txt
NITF Files: The RSM interpreter has the capability of reading this file and generating
i_6130c.ntf
Internet


File Download
Do you want to open or save this file?
Name: i_6130a.zip
Type: Compressed (zipped) Folder, 91.7KB
From: www.gwg.nga.mil
Open
Save
Cancel
Always ask before opening this type of file
While files from the Internet can be useful, some files can potentially harm your computer. If you do not trust the source, do not open or save this file. What's the risk?

- Remaining within the Frame Set 1 row, download the NITF file containing the RSM TREs by clicking on the zip files (i_6130a.ntf (.zip file)) and save to the folder Frame Set 1. Each unzipped NITF file is 90 MB.

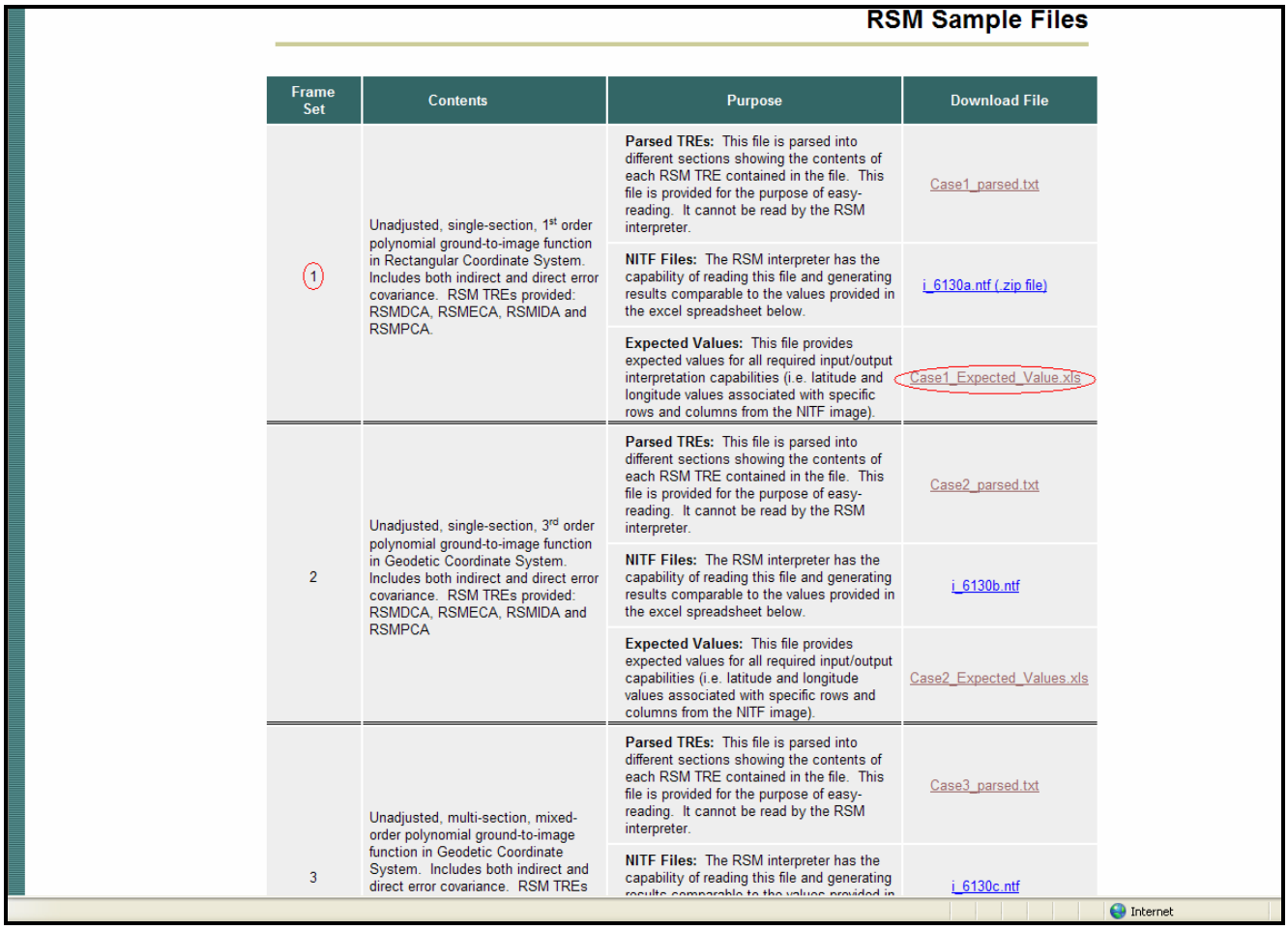


RSM Sample Files

Frame Set	Contents	Purpose	Download File
1	Unadjusted, single-section, 1st order polynomial ground-to-image function in Rectangular Coordinate System. Includes both indirect and direct error covariance. RSM TREs provided: RSMDCA, RSMECA, RSMIDA and RSMPCA.	**Parsed TREs:** This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.	Case1_parsed.txt
		NITF Files: The RSM interpreter has the capability of reading this file and generating results comparable to the values provided in the excel spreadsheet below.	i_6130a.ntf (.zip file)
		Expected Values: This file provides expected values for all required input/output interpretation capabilities (i.e. latitude and longitude values associated with specific rows and columns from the NITF image).	Case1_Expected_Value.xls
2	Unadjusted, single-section, 3rd order polynomial ground-to-image function in Geodetic Coordinate System. Includes both indirect and direct error covariance. RSM TREs provided: RSMDCA, RSMECA, RSMIDA and RSMPCA	**Parsed TREs:** This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.	Case2_parsed.txt
		NITF Files: The RSM interpreter has the capability of reading this file and generating results comparable to the values provided in the excel spreadsheet below.	i_6130b.ntf
		Expected Values: This file provides expected values for all required input/output capabilities (i.e. latitude and longitude values associated with specific rows and columns from the NITF image).	Case2_Expected_Values.xls
3	Unadjusted, multi-section, mixed-order polynomial ground-to-image function in Geodetic Coordinate System. Includes both indirect and direct error covariance. RSM TREs	**Parsed TREs:** This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.	Case3_parsed.txt
		NITF Files: The RSM interpreter has the capability of reading this file and generating results comparable to the values provided in	i_6130c.ntf

Internet

- Next, still remaining within the Frame Set 1 row, download the Excel file labeled Case1_Input_Output.exl located on the right side of the table. Click on the file name, and save to the folder Frame Set 1.

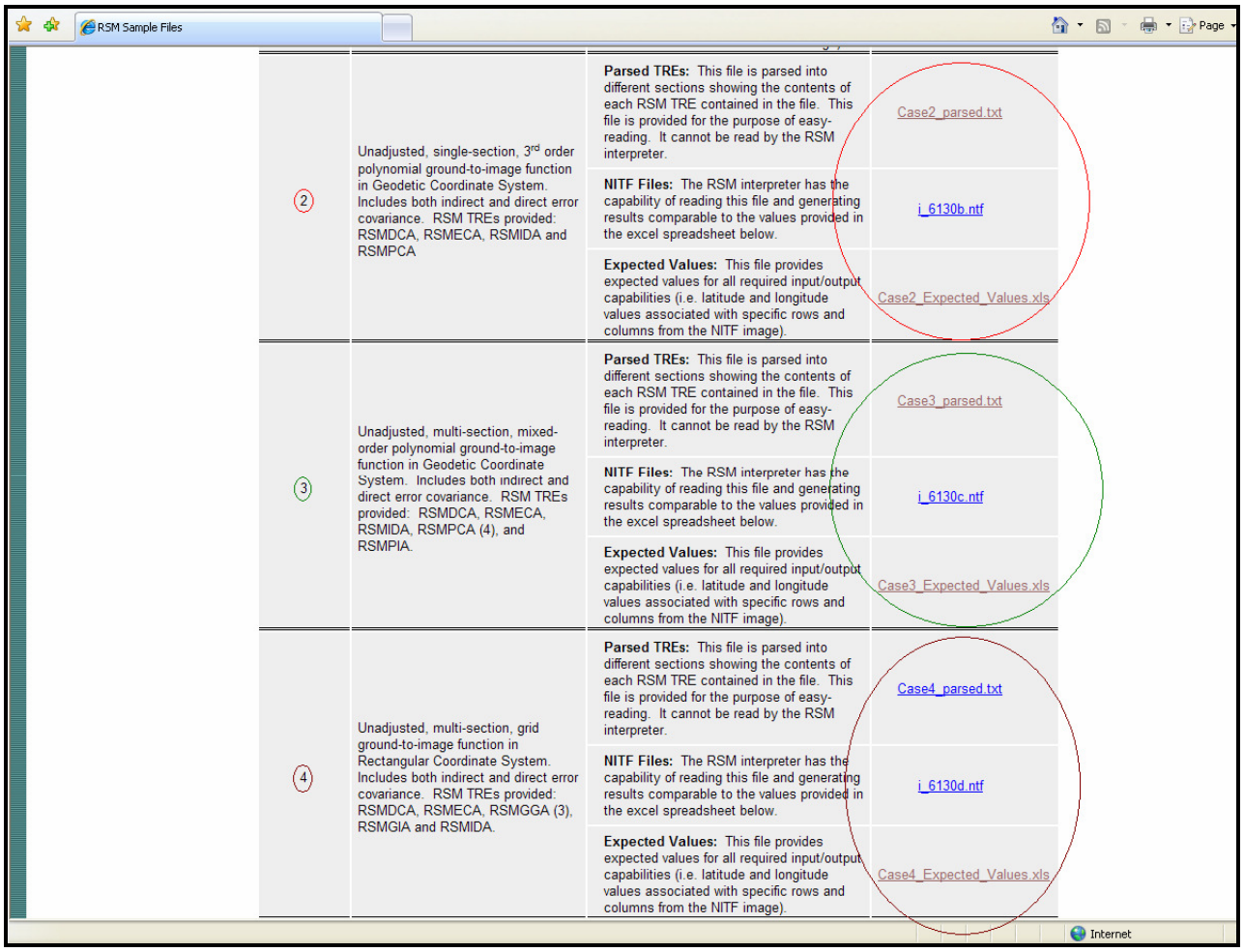


RSM Sample Files

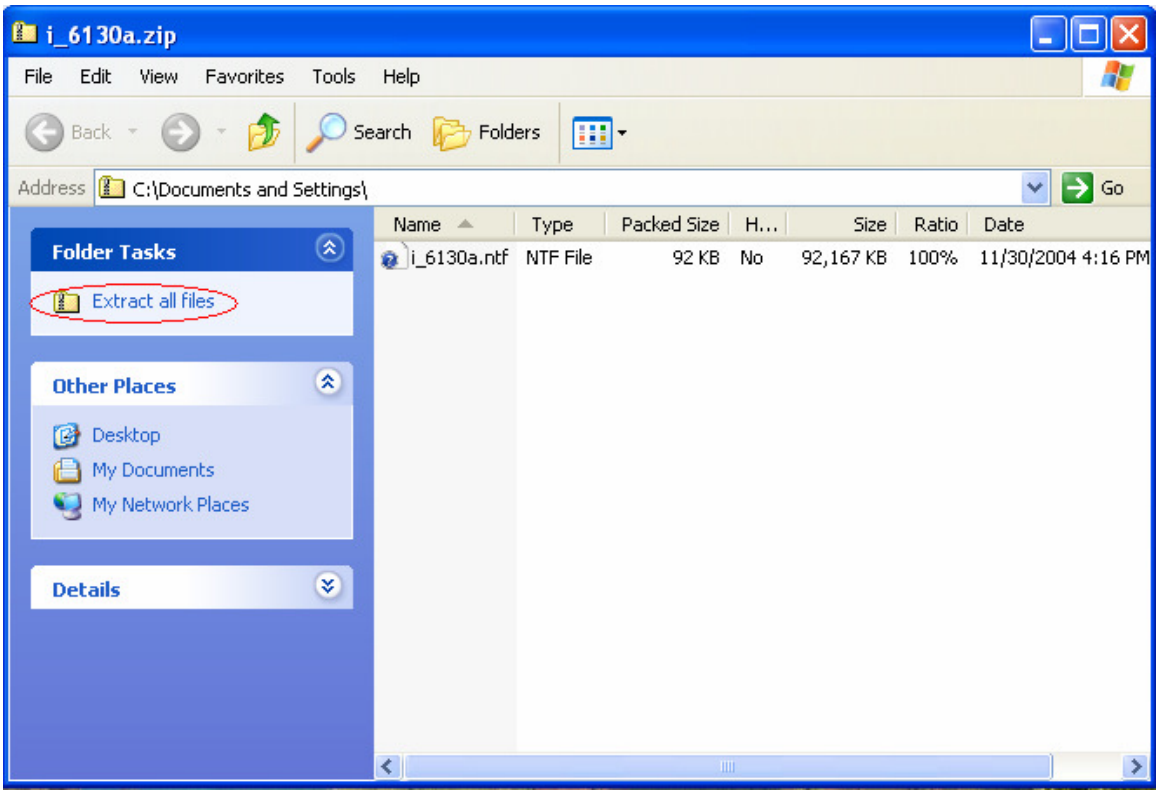
Frame Set	Contents	Purpose	Download File
1	Unadjusted, single-section, 1st order polynomial ground-to-image function in Rectangular Coordinate System. Includes both indirect and direct error covariance. RSM TREs provided: RSMDCA, RSMECA, RSMIDA and RSMPCA.	**Parsed TREs:** This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.	Case1_parsed.txt
		NITF Files: The RSM interpreter has the capability of reading this file and generating results comparable to the values provided in the excel spreadsheet below.	i_6130a.ntf (.zip file)
		Expected Values: This file provides expected values for all required input/output interpretation capabilities (i.e. latitude and longitude values associated with specific rows and columns from the NITF image).	Case1_Expected_Value.xls
2	Unadjusted, single-section, 3rd order polynomial ground-to-image function in Geodetic Coordinate System. Includes both indirect and direct error covariance. RSM TREs provided: RSMDCA, RSMECA, RSMIDA and RSMPCA	**Parsed TREs:** This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.	Case2_parsed.txt
		NITF Files: The RSM interpreter has the capability of reading this file and generating results comparable to the values provided in the excel spreadsheet below.	i_6130b.ntf
		Expected Values: This file provides expected values for all required input/output capabilities (i.e. latitude and longitude values associated with specific rows and columns from the NITF image).	Case2_Expected_Values.xls
3	Unadjusted, multi-section, mixed-order polynomial ground-to-image function in Geodetic Coordinate System. Includes both indirect and direct error covariance. RSM TREs	**Parsed TREs:** This file is parsed into different sections showing the contents of each RSM TRE contained in the file. This file is provided for the purpose of easy-reading. It cannot be read by the RSM interpreter.	Case3_parsed.txt
		NITF Files: The RSM interpreter has the capability of reading this file and generating	i_6130c.ntf

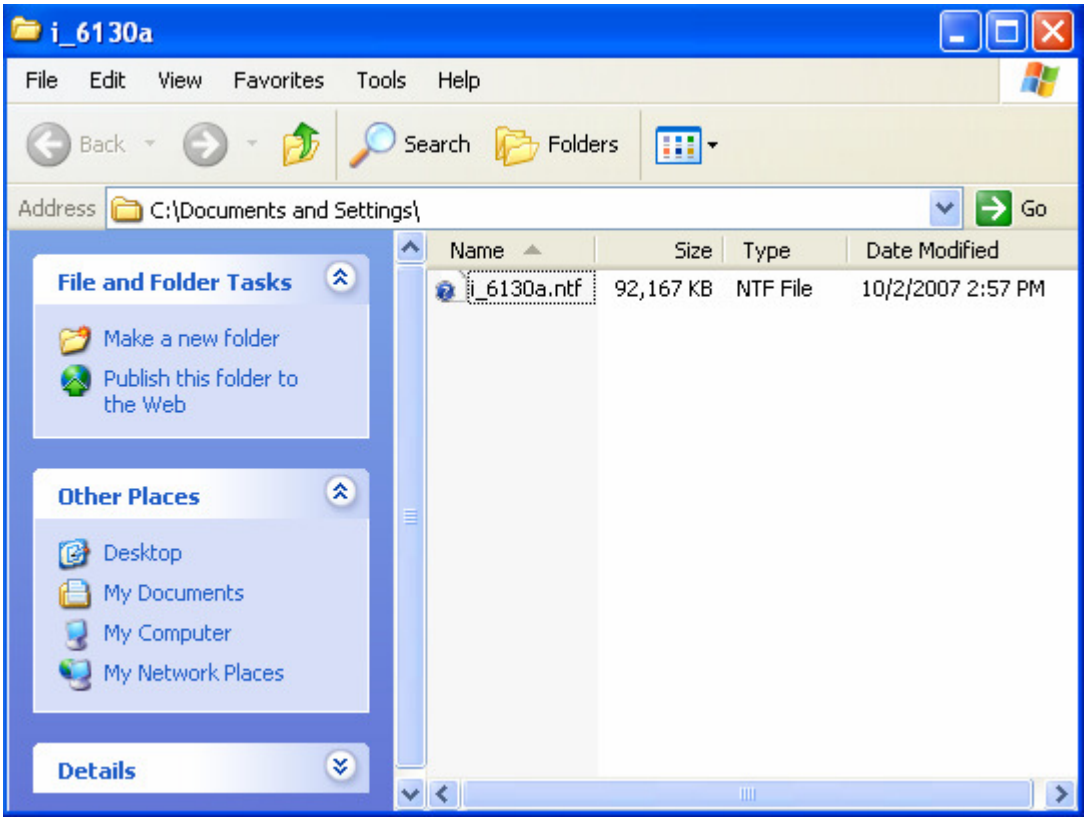
Internet

- Continue downloading each Frame Set group of files and saving each file in the appropriate folder. When all the files are saved, all Frame Set folders located on your hard drive should contain 3 files each; one text file, one zipped NITF file and one Excel file.



- Open the Frame Set 1 folder and double click on the zipped NITF file to extract the image. Save the extracted file to the Frame Set 1 folder. The NITF file is now ready to be read by the RSM interpreter.


i_6130a.zip
File Edit View Favorites Tools Help
Back Search Folders
Address C:\Documents and Settings\
Go
Folder Tasks
Extract all files
Other Places
Desktop
My Documents
My Network Places
Details
Name Type Packed Size H... Size Ratio Date
i_6130a.ntf NTF File 92 KB No 92,167 KB 100% 11/30/2004 4:16 PM


i_6130a
File Edit View Favorites Tools Help
Back Search Folders
Address C:\Documents and Settings\
Go
File and Folder Tasks
Make a new folder
Publish this folder to the Web
Other Places
Desktop
My Documents
My Computer
My Network Places
Details
Name Size Type Date Modified
i_6130a.ntf 92,167 KB NTF File 10/2/2007 2:57 PM

- Open all the Frame Set folders and extract all the NITF images from the zipped file. Save the extracted files to the appropriate Frame Set folder.

Step 2. Interpret the NITF image RSM TREs and capture the output values.

- Open the Frame Set 1 Excel spreadsheet that was downloaded from the NITF website.
- Run the RSM interpreter.
- Open the NITF file from the Frame Set 1 folder with the RSM interpreter.
  - Provide the row/column values for the input lat/long/height values provided on the spreadsheet.
    - Compare the row/column values given by the RSM interpreter to the values given on the spreadsheet.
      - The values should be no greater than +5.0E-02 pixels difference.
  - Provide the partial derivatives of a row/column with respect to a ground point.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
      - The value displayed from the requested ground point is within 0.05 seconds, or +2.42252E-07 radians, when compared to the value from the spreadsheet.
  - Provide the partial derivatives of image row/column with respect to a supplied RSM adjustable parameter identification.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
      - The value displayed from the requested image point locating partial derivative is within 0.001 pixels when compared to the value from the spreadsheet
  - Provide the RSM direct error covariance, corresponding original full image ID and number of active RSM "error model" adjustable parameters for each applicable image. Also provide the ID of the parameters for the associated image.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
      - The value displayed for the requested corresponding original full image identification is the same value and the same amount of bytes, up to 80 total, as the original full image identification display value from the RSM reference test cases.
      - The value displayed for the requested number of active RSM error model adjustable parameters for each applicable image is the same value (01-36, two bytes total) as the number display value from the RSM reference test cases.

- The value displayed for the requested identification and value of the RSM error model adjustable parameters for the associated image is the same value (01-36,two bytes total) as the identifications display value from the RSM reference test cases.
- The value displayed for the requested RSM direct error covariance contains the same values (in the range and byte size as ±9.99999999999999E±99) as the display value from the RSM reference test cases.

- Provide the RSM indirect error covariance.
  - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
    - The values displayed for the requested original full image identification for each image is the same value and the same amount of bytes, up to 80 total, as the display values from the RSM reference test cases.
    - The values displayed for the requested indirect error covariance at supplied row/column locations and corresponding image IDs are the same values as compared to the display value from the RSM reference test cases.
    - The values displayed for the requested corresponding number and identification of all active RSM error model adjustable parameters for each image is the same value (01-36, two bytes total) as the display value from the RSM reference test cases.
    - The values displayed for the requested value of all active RSM error model adjustable parameters for each image is the same value as the display values from the RSM reference test cases.
    - The values displayed for the requested RSM indirect error covariance for a set of images from the same sensor is the same value as the display values from the RSM reference test cases.
- Provide the 2x2 unmodeled error covariance, the 2x2 unmodeled error cross-covariance corresponding to two specified (r,c) locations, and the 2x2 unmodeled error cross-covariance corresponding to a ground point location in the associated image.
  - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
    - The values displayed from the requested 2 x 2 unmodeled error covariance corresponding to a row and column location is within +1.0E+00 of the display values from the RSM reference test cases.

        - The values displayed from the requested 2 x 2 unmodeled error cross-covariance corresponding to two specified row and column locations is within +1.0E+00 of the display values from the RSM reference test cases.
        - The values displayed from the requested 2 x 2 unmodeled error cross-covariance corresponding to a ground point location(s) is within +1.0E+00 of the display values from the RSM reference test cases.
- Provide the Illumination azimuth and elevation angle.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested illumination azimuth/elevation angle at a supplied row/column location is the same value as the display value from the RSM reference test cases.
- Provide the trajectory position and velocity.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested trajectory position at a supplied time is the same value as the display value from the RSM reference test cases.
        - The value displayed from the requested velocity at a supplied time is the same value as the display value from the RSM reference test cases.
- Provide the image identification.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested original full image identification is the same as the display value from the RSM reference test cases.
- Provide the sensor identification.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested sensor identification is the same as the display value from the RSM reference test cases.
- Provide sensor type.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested sensor type is the same as the display value from the RSM reference test cases.
- Provide the original full image size.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.

        - The value displayed from the requested original full image size is the same as the display value from the RSM reference test cases.
- Provide the RSM image domain.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested RSM image domain is the same as the display value from the RSM reference test cases.
- Provide the edition identification.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested edition identification is the same as the display value from the RSM reference test cases.
- Provide the triangulation identification.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested original full image size is the same as the display value from the RSM reference test cases.
- Provide the RSM ground domain height range.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested RSM ground domain height range is within +1.0E+00 of the display value from the RSM reference test cases.
- Provide the time of image corresponding to a row/column or ground point location.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested time of image corresponding to a supplied row and column location is the same as the display value from the RSM reference test cases.
        - The value displayed from the requested time of image corresponding to a supplied ground point location is the same as the display value from the RSM reference test cases.
- Provide the RSM primary ground coordinate system.
    - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
        - The value displayed from the requested RSM primary ground coordinate system is the same as the display value from the RSM reference test cases.

- Provide the polynomial and/or grid ground-to-image functional fit error value.
  - Compare the values given by the RSM interpreter to the values given on the spreadsheet.
    - The value display from the requested polynomial ground-to-image functional fit error is within +1.00E-10 of the display value from the RSM reference test cases for both row and column in each section.
    - The value displayed from the requested grid ground-to-image functional fit error is within +1.00E-10 of the display value from the RSM reference test cases for each row and column in each section.